	Development Document - Western Alkaline Coal Mining Subcategory
APPENDIX D: Mine Model Input and C	ling and Performance Analysis - Model Output Data



Introduction

This Appendix contains model input and output data for the mine modeling performed for NMA using RUSLE version 1.06 and SEDCAD 4.0. This study was submitted to EPA as "DRAFT - Western Alkaline Mining Subcategory Mine Modeling and Performance-Cost-Benefit Analysis" in support of the Western Alkaline Mining Subcategory proposal (WCMWG, 1999c). These data and information support the sedimentology and hydrology modeling results presented in Section 6, Case Study 1 of this document. The supporting input and output data for the RUSLE modeling is presented first (Tables D-1 through D-6) followed by the SEDCAD output information (Exhibits D-1 through D-3)...

RUSLE Version 1.06 Modeling

Soil loss estimates from a representative model mine were developed using RUSLE version 1.06. The backup input and output data are summarized in table form here as:

- Table D-1: RUSLE Input Variables For Premining Subwatersheds
- Table D-2: Premining RUSLE Model Output
- Table D-3: RUSLE Input Variables For Reclaimed Subwatersheds
- Table D-4: Input And Output Variables For Reclaimed Areas
- Table D-5: Postmining Reclamation RUSLE Erosion Model Output
- Table D-6: Weighted Average Soil Loss Estimates For Disturbed and Reclaimed Subwatersheds (RUSLE)

SEDCAD Version 4.0 Modeling

Hydrology and sedimentology data were generated for the model mine under three scenarios: undisturbed (premining) conditions; reclamation under current 40 CFR Part 434 guidelines; and reclamation with alternative BMPs. The supporting reports as produced by SEDCAD for the three scenarios are presented in this Appendix:

- Exhibit D-1: Premining Undisturbed Conditions
- Exhibit D-2: Postmining Reclaimed Conditions, Existing Guidelines
- Exhibit D-3: Postmining Reclaimed Conditions, Proposed Subcategory

TABLE D-1: RUSLE Input Variables For Premining Subwatersheds

	Reclaimed									
	Watershed							Composite		
Reclaimed Watershed	Area	R	K	L	S	C	P	Curve Number	Hydrologic Condition	
SW3A	(acres) 31.2	30	0.29	700	3.5	0.45	1.00	81	Condition	
SW3B	15.5	30	0.29	435	5.0	0.45	1.00	79	В	
5 W 3 B	13.3	30	0.24	433	3.0	0.43	1.00	12	В	
SW7	25.9	30	0.32	500	10.0	0.45	0.47	88	D	
SW9	290.0	30	0.24	425	7.0	0.45	1.00	77	В	
SW10	14.0	30	0.32	500	6.7	0.45	1.00	90	D	
5 W 10	14.0	30	0.32	300	0.7	0.43	1.00	70		
SW11	15.0	30	0.35	275	7.1	0.45	1.00	91	D	
SW13	105.3	30	0.27	390	6.7	0.45	1.00	81	С	
SW14	9.3	30	0.32	300	5.4	0.45	1.00	88	D	
SW15	30.520	30	0.32	160	12.5	0.45	1.00	88	D	
SW17	78.5	30	0.36	375	7.6	0.45	1.00	92	D	
Subtotal	616.7		Acres for	r subwa	itershed			381.8 acres of	mining	
			ı	I		disturba	nce.	I	I	
SW1A	44.6	30	0.37	650	4.5	0.45	1.00	93	D	
SW1B	140.1	30	0.37	800	3.0	0.45	1.00	93	D	
SWID	140.1	30	0.57	000	3.0	0.43	1.00	75	Б	
SW2	104.1	30	0.37	850	2.5	0.45	1.00	93	D	
SW4	75.3	30	0.35	350	7.0	0.45	1.00	92	D	
SW5	5.5	30	0.32	190	10.0	0.45	1.00	88	D	
SW6	26.1	30	0.37	250	8.0	0.45	1.00	93	D	
CINO	22.0	20	0.27	215	()	0.45	1.00	0.2	D	
SW8	23.8	30	0.37	315	6.3	0.45	1.00	93	D	
SW12	72.6	30	0.37	360	8.3	0.45	1.00	93	D	
SW16	55.9	30	0.33	440	8.2	0.45	1.00	92	D	
SW18	23.3	30	0.32	375	7.0	0.45	1.00	88	D	
	571.3									
Subtotal	.7/11		acres for subwatershed area that will not be disturbed by mining.							

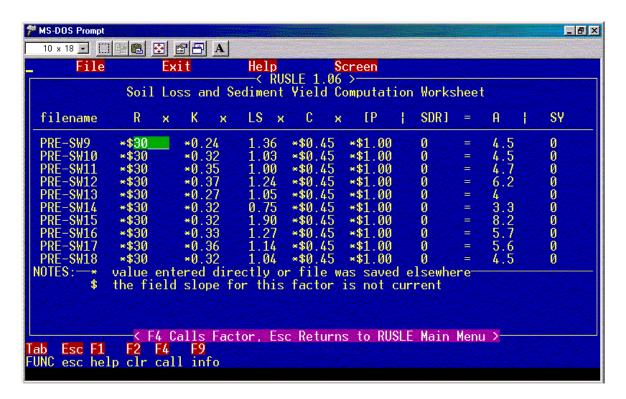
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TABLE D-1: RUSLE Input Variables For Premining Subwatersheds (Continued)

Reclaimed Watershed	Soil Type	Surface Condition	Number of Years to Consolidate	General Land Use
SW3A	Loamy Sand	Undisturbed	7	6
SW3B	Loamy Sand	Undisturbed	7	6
SW7	Sandy Clay Loam	Undisturbed	7	6
SW9	Loamy Sand	Undisturbed	7	6
SW10	Sandy Clay Loam	Undisturbed	7	6
SW11	Sandy Clay Loam	Undisturbed	7	6
SW13	Loamy Sand	Undisturbed	7	6
SW14	Sandy Clay Loam	Undisturbed	7	6
SW15	Sandy Clay Loam	Undisturbed	7	6
SW17	Sandy Clay Loam	Undisturbed	7	6
SW1A SW1B	Sandy Clay Loam Sandy Clay Loam	Undisturbed Undisturbed	7	6
SW2	Sandy Clay Loam Sandy Clay Loam	Undisturbed	7	6
SW4	Sandy Clay Loam	Undisturbed	7	6
SW5	Sandy Clay Loam	Undisturbed	7	6
SW6	Sandy Clay Loam	Undisturbed	7	6
SW8	Sandy Clay Loam	Undisturbed	7	6
SW12	Sandy Clay Loam	Undisturbed	7	6
SW16	Sandy Clay Loam	Undisturbed	7	6
SW18	Sandy Clay Loam	Undisturbed	7	6

TABLE D-2: Premining RUSLE Model Output

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PRE-SW1A	*\$30	*80	.37	0.68	*\$0.45	*\$1.00	0		3.4	0
PRE-SW1B	*\$30		.37	0.42	*\$0.45	*\$1.00	0		2.1	0
PRE-SW2	*\$30	*0	.37	0.37	*\$0.45	*\$1.00	0		1.8	0
PRE-SW3A	*\$30	*0	.29	0.55	*\$0.45	*\$1.00			2.2	0
PRE-SW3B	*\$30	*0		1.12	*\$0.45				3.6	0
PRE-SW4	*\$30	Killian and Salah Sa	. 35	1.02	*\$0.45				4.9	0
PRE-SW5	*\$30			1.43	*\$0.45			**	6.2	0
PRE-SW6		*0			*\$0.45	Charles Control Control of Control			5.6	0
PRE-SW7	*\$30	artini e e e e e e e e e e e e e e e e e e		State of the Control	*\$0.45	The Control of State of Control of Control			7.5	0
PRE-SW8	*\$30	_	. 37	0.90	*\$0.45		0		4.5	0
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TABLE D-3: RUSLE Input Variables For Disturbed/Reclaimed Subwatersheds

	Reclaimed							~ .	
	Watershed							Composite	
Reclaimed	Area	_		_	~	~	_	Curve	Hydrologic
Watershed	(acres)	R	K	L	S	C	P	Number	Condition
SW3A	20.295	30	0.29	650	7.0	0.45	1.00	80	В
SW3B	14.907	30	0.25	750	3.5	0.45	1.00	79	В
SW3C	8.414	30	0.24	250	11.0	0.45	1.00	79	В
SW3D	11.884	30	0.15	500	6.0	0.31	0.47	65	A
SW3E	5.500	30	0.29	450	6.0	0.05	0.44	74	В
SW3F	6.443	30	0.24	400	2.6	0.45	1.00	79	В
SW3G	14.513	30	0.24	475	5.0	0.63	0.45	74	В
SW3H	70.798	30	0.24	550	2.9	0.49	0.63	74	В
SW3I	8.314	30	0.24	250	8.2	0.45	1.00	79	В
SW7A	9.965	30	0.24	500	6.4	0.45	0.69	74	В
SW7B	11.735	30	0.32	125	8.0	0.45	1.00	88	D
SW9A	40.766	30	0.26	340	7.3	0.45	1.00	80	С
SW9B	7.113	30	6.3	250	6.0	0.31	0.47	65	A
SW9C	29.932	30	71.8	375	5.5	0.48	0.51	74	В
SW9D	9.575	30	36.4	400	6.4	0.45	0.69	74	В
SW9E	30.520	30	94.6	475	4.5	0.51	0.72	74	В
SW10	8.058	30	35.5	225	7.5	0.45	1.00	92	D
SW11A	15.142	30	59.1	500	6.0	0.45	0.69	74	В
SW11B	13.858	30	44.3	275	7.1	0.45	1.00	91	D
SW13A	22.100	30	57.5	500	5.0	0.45	1.00	79	В
SW13B	7.328	30	22.0	100	6.4	0.45	1.00	81	С
SW13C	13.158	30	12.8	450	5.0	0.31	0.47	65	A
SW13D	8.547	30	7.5	250	6.0	0.31	0.47	65	A
SW13E	13.831	30	13.4	250	5.0	0.30	0.45	74	В
SW13F	9.556	30	29.6	275	9.0	0.45	0.46	74	В
SW13G	16.221	30	50.3	375	6.6	0.55	0.47	74	В
SW13H	13.248	30	60.9	385	8.0	0.63	0.47	74	В
SW13I	12.053	30	35.0	375	5.3	0.49	0.63	74	В
SW13J	35.792	30	78.7	525	3.8	0.47	0.67	74	В
SW14A	5.974	30	16.1	300	5.4	0.45	0.69	74	В
SW14B	4.650	30	15.3	300	5.4	0.45	1.00	88	D
SW15A	15.352	30	64.5	375	7.2	0.45	0.69	74	В
SW15B	16.414	30	72.2	600	6.4	0.45	1.00	88	D
SW17A	3.038	30	11.5	100	6.5	0.45	1.00	93	D
SW17B	12.123	30	14.5	450	6.0	0.31	0.47	74	В
SW17C	8.741	30	8.3	450	6.0	0.18	0.45	74	В
SW17D	10.010	30	44.0	475	7.0	0.63	0.47	74	В
SW17E	50.821	30	264.3	375	7.0	0.45	1.00	92	D
Total	616.7	-							

TABLE D-3: RUSLE Input Variables For Disturbed/Reclaimed Subwatersheds (Continued)

			Number of	General
Reclaimed			Years to	General Land Use
Watershed	Soil Tymo	Surface Comdition	Consolidate	Land Use
SW3A	Soil Type Loamy Sand	Undisturbed Undisturbed	Consolidate	6
SW3B	Loamy Sand	Undisturbed	7	6
SW3C	Loamy Sand	Undisturbed	7	6
SW3D	Loamy Sand	Spoil, backfilled & graded	10	10
SW3E	Loamy Sand	Topdressed, straw mulched & seeded	10	8
SW3F	Loamy Sand Loamy Sand	Undisturbed	7	6
SW3G	Loamy Sand Loamy Sand	Reveg. 1-3 Years	10	8
SW3H	Loamy Sand Loamy Sand	Reveg. 4-8 years/some reveg. 1-3 years	10	8
SW3I	Loamy Sand	Undisturbed	7	6
SW7A	Loamy Sand	Reveg. 4-8 years	10	8
SW7B	Sandy Clay Loam	Undisturbed	7	6
SW9A	Loamy Sand	Undisturbed	7	6
SW9B	Loamy Sand Loamy Sand	Spoil, backfilled & graded	10	10
SW9C	Loamy Sand Loamy Sand	Reveg. 1-3 Years/some topdressed area	10	8
SW9D	Loamy Sand	Reveg. 4-8 years	10	8
SW9E	Loamy Sand Loamy Sand	Reveg. 4-8 years/some 1-3 years/some undisturbed	10	8
SW10	Sandy Clay Loam	Undisturbed	7	6
SW10 SW11A	Loamy Sand	Reveg. 4-8 years	10	8
SW11A SW11B	Sandy Clay Loam	Undisturbed	7	6
SW11B SW13A	Loamy Sand	Undisturbed	7	6
SW13A SW13B	Loamy Sand Loamy Sand	Undisturbed	7	6
SW13B SW13C	,	Spoil, backfilled & graded	10	10
SW13D	Loamy Sand	Spoil, backfilled & graded Spoil, backfilled & graded	10	10
SW13D SW13E	Loamy Sand Loamy Sand	Topdressed/some reveg. 1-3 years		8
	,	Reveg. 1-3 Years/some topdressed area	10	
SW13F	Loamy Sand	Reveg. 1-3 Years/some topdressed area	10	8
SW13G	Loamy Sand	Reveg. 1-3 Years/some reveg. 4-8 years	10	8
SW13H	Loamy Sand	Reveg. 1-3 Years/some reveg. 4-8 years Reveg. 4-8 Years/some reveg. 1-3 years	10	Ü
SW13I	Loamy Sand	Reveg. 4-8 Years/some reveg. 1-3 years Reveg. 4-8 Years/some reveg. 1-3 years	10	8
SW13J	Loamy Sand		10	8
SW14A	Loamy Sand	Reveg. 4-8 Years	10	8
SW14B	Sandy Clay Loam	Undisturbed	7	6
SW15A	Loamy Sand	Reveg. 4-8 Years/some reveg. 1-3 years	10	8
SW15B	Sandy Clay Loam	Undisturbed	7	6
SW17A	Sandy Clay Loam	Undisturbed	7	6
SW17B	Loamy Sand	Spoil, backfilled & graded	10	10
SW17C	Loamy Sand	Topdressed/some reveg. 1-3 years	10	8
SW17D	Loamy Sand	Reveg. 1-3 years/some topdressed/some spoil	10	8
SW17E	Sandy Clay Loam	Undisturbed/some reclaimed	7	6

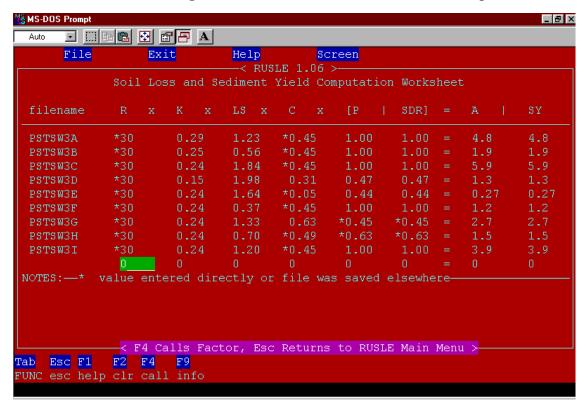
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TABLE D-4: RUSLE Model Input And Output Variables For Reclaimed Areas

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filename	R x	K x	LS x	C x	[P]	SDR]		A	SY
SPOIL	*30	0.15	0.94	0.31	0.47	0.47		0.62	0.62
TOPDRESS	*30	0.24	0.82	0.05	0.44	0.44		0.14	0.14
REVEG1-3		0.24	0.82	0.63	0.47	0.47		1.8	1.8
REVEG4-8	*30	0.24	0.82	0.45	0.69	0.69		1.8	1.8
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	0	0	0	0	0	0		0	0
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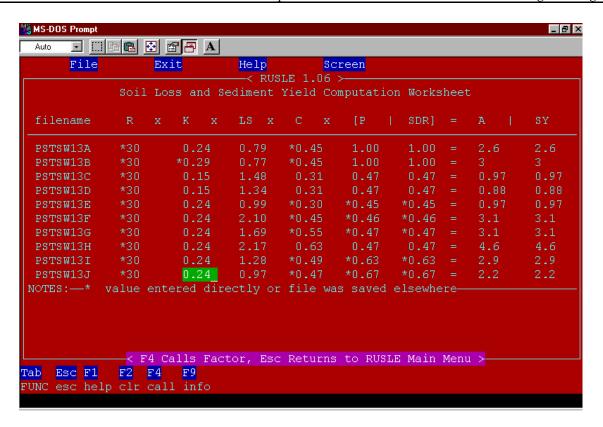
Area Filename	<u>Description</u>
SPOIL	Mine spoil backfilled and graded, consisting of loamy sand overburden; $CN = 65$; $k = 0.15$; hydrologic condition = A; 25% gravel, 10% cobble, 5% rock fragments; slow hydrologic response time.
TOPDRESS	Area topdressed, consisting of loamy sand topsoil; roughened with contour furrows; straw mulched (2 tons/acre); recently seeded with no growth started; $CN=74;\ k=0.24;$ hydrologic condition = B; medium hydrologic response time.
REVEG1-3	Area originally prepared the same as previous topdressed area; 1-3 years of vegetative growth; surface roughening slightly decreased from erosion, sedimentation, and consolidation; $CN = 74$, $k = 0.24$; hydrologic condition = B; medium hydrologic response time.
REVEG1-4	Area originally prepared the same as previous topdressed area; 4-8 years of vegetative growth typically more dense than area with 1-3 years of vegetative growth; surface roughening continuing to decrease from erosion, sedimentation, and consolidation; $CN = 74$, $k = 0.24$; hydrologic condition = B; medium hydrologic response time.

TABLE D-5: Postmining Reclamation RUSLE Erosion Model Output



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	Soil L	oss and S				on Works	heet	5
filename	R x	K x	LS x	C x	[P	SDR]	=	A
PSTSW7A	*30	0.24	1.87	0.45	0.69	0.69	=	4.2
PSTSW7B	*30	0.32	0.98	*0.45	1.00	1.00	=	4.3
PSTSW9A	*30	0.26	1.13	*0.45	1.00	1.00	=	4
PSTSW9B	*30	0.15	1.34	0.31	0.47	0.47	=	0.88
PSTSW9C	*30	0.24	1.34	*0.48	*0.51	*0.51	=	2.4
PSTSW9D	*30	0.24	1.68	0.45	*0.69	*0.69	=	3.8
PSTSW9E	*30	0.24	1.16	*0.51	*0.72	*0.72	=	3.1
PSTSW10	*30	0.32	1.02	*0.45	1.00	1.00	=	4.4
PSTSW11A	*30	0.24	1.72	0.45	0.69	0.69	=	3.9
PSTSW11B	*30	*0.24	1.00	*0.45	1.00	1.00	=	3.2
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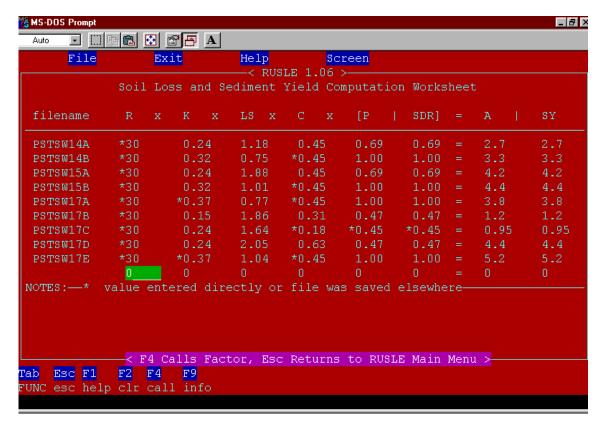


TABLE D-6: Weighted Average Soil Loss Estimates For Undisturbed And Reclaimed Watersheds (RUSLE)

U	NDISTURBED	WATERSHE	ED	RECLAIMED WATERSHED					
	Undisturbed	Average	Average	Reclaimed Average Avera					
	Watershed	Annual	Annual		Watershed	Annual	Annual		
Undisturbed	Area	Soil Loss	Soil Loss	Reclaimed	Area	Soil Loss	Soil Loss		
Watershed	(acres)	(tons/acre)	(tons)	Watershed	(acres)	(tons/acre)	(tons)		
SW3A	31.2	2.2	68.7	SW3A	20.3	4.8	97.4		
SW3B	15.5	3.6	55.8	SW3B	14.9	1.9	28.3		
				SW3C	8.4	5.9	49.6		
				SW3D	11.9	1.3	15.4		
				SW3E	5.5	0.27	1.5		
				SW3F	6.4	1.2	7.7		
				SW3G	14.5	2.7	39.2		
				SW3H	70.8	1.5	106.2		
SW7	25.9	7.5	194.2	SW3I	8.3	3.9	32.4		
				SW7A	10.0	4.2	41.9		
				SW7B	11.7	4.3	50.5		
SW9	290.0	4.5	1305.0	SW9A	40.8	4.0	163.1		
				SW9B	7.1	0.88	6.3		
				SW9C	29.9	2.4	71.8		
				SW9D	9.6	3.8	36.4		
				SW9E	30.5	3.1	94.6		
SW10	14.0	4.5	63.1	SW10	8.1	4.4	35.5		
SW11	15.0	4.7	70.6	SW11A	15.1	3.9	59.1		
				SW11B	13.9	3.2	44.3		
SW13	105.3	4.0	421.2	SW13A	22.1	2.6	57.5		
				SW13B	7.3	3.0	22.0		
				SW13C	13.2	0.97	12.8		
				SW13D	8.5	0.88	7.5		
				SW13E	13.8	0.97	13.4		
				SW13F	9.6	3.1	29.6		
				SW13G	16.2	3.1	50.3		
				SW13H	13.2	4.6	60.9		
				SW13I	12.1	2.9	35.0		
				SW13J	35.8	2.2	78.7		
SW14	9.3	3.3	30.7	SW14A	6.0	2.7	16.1		
				SW14B	4.7	3.3	15.3		
SW15	32.0	8.2	262.0	SW15A	15.4	4.2	64.5		
				SW15B	16.4	4.4	72.2		
SW17	78.5	5.6	439.6	SW17A	3.0	3.8	11.5		
				SW17B	12.1	1.2	14.5		
				SW17C	8.7	0.95	8.3		
				SW17D	10.0	4.4	44.0		
				SW17E	50.8	5.2	264.3		
Totals	616.7		2911.0		616.7		1859.8		
Weighted Ave	rage Soil Loss =	4.7 tons/acre/	yr.	Weighted A	verage Soil Lo	oss = 3.0 tons/a	acre/yr.		

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